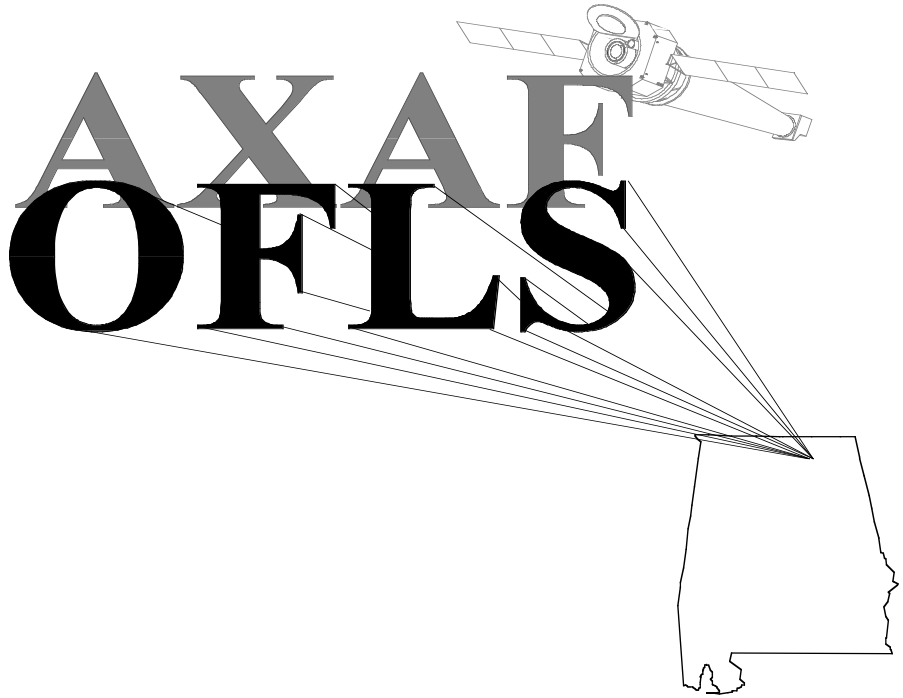

Momentum Management Updates

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February 2, 1996

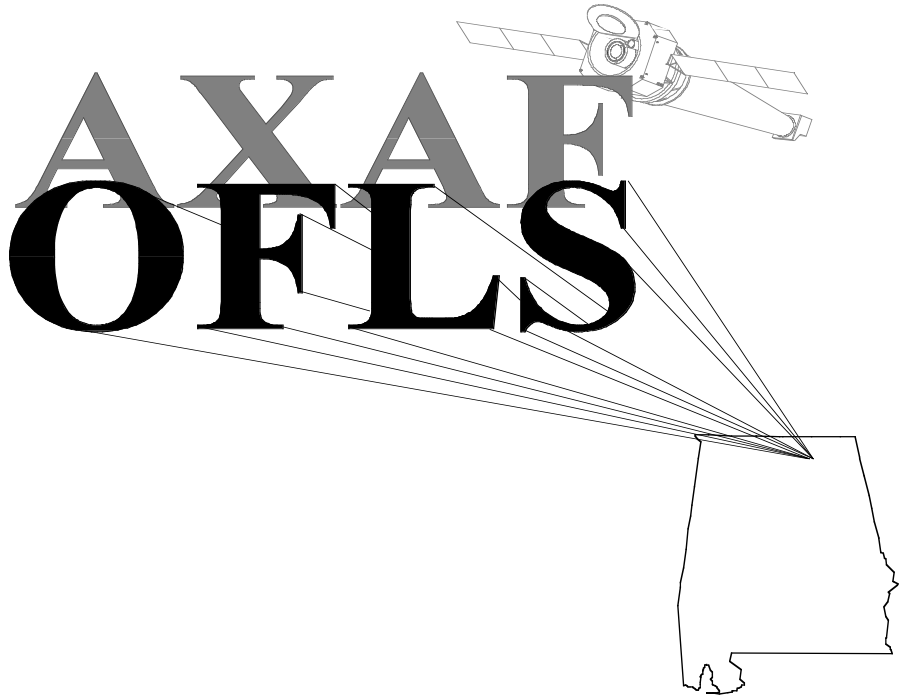
Momentum Management Updates

TRW momentum analysis shows

- **no appreciable effect on momentum build-up due to changes in solar array rotation**
- **small (~4%) effect on momentum build-up due to SIM position (ACIS vs HRC)**

Updates to the MPS momentum management design

- **remove solar array rotation dependence from both solar radiation and gravity gradient computations**
- **treat solar array as a fixed “plane” for solar radiation computations**
- **add SIM position dependence to gravity gradient computations using three moment of inertia tensors from the database: ACIS, HRC, center**



IRU Calibration Support

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February 2, 1996

IRU Calibration Overview

Typical ground IRU calibration scenario using AD&SC

- **determine attitude before and after a maneuver**
- **determine attitude after a maneuver by propagating IRU data to the end of the maneuver**
- **determine the difference between the IRU propagated and the “true” post-maneuver attitude**
- **determine corrections to the IRU calibration parameters to most accurately model the maneuver**

Maneuvers could be preplanned by the MPS or “serendipitous” based on the type of calibration

IRU Calibration Overview

Two types of IRU calibrations

- **Bias calibrations**
  - **on previous missions, performed routinely by ground operations based on nominal mission maneuver scenarios (requires no special maneuver planning)**
  - **on AXAF, performed onboard by flight software based on nominal mission maneuver scenarios**
- **Scale factor/misalignment calibrations**
  - **on previous missions, performed infrequently by ground operations based on a preplanned sequence of 2 or 3 special calibration maneuvers**
  - **on AXAF, per TRW analysis, performed routinely by ground operations; may require special calibration maneuvers or place requirements on nominal mission maneuver scenarios**

IRU Calibration Analysis

TRW IRU Calibration Analysis

- **Assumptions**
  - **long term IRU stability requirement is 0.1 arcsec/sec and 3.6 arcsec/sec**
  - **at least 15 maneuvers per week**
  - **average observation duration of 29,000 seconds, minimum observation duration of 21,600 seconds, maximum observation duration of 40,000 seconds**
  - **star catalog accuracy of 0.6 arcseconds**

TRW Analysis Conclusions

Kalman filter is required in the OFLS attitude determination software

With a Kalman filter, can guarantee star acquisition (within 100 arcsec of target attitude) for a 180 degree maneuver if

- **greater than 15 maneuvers in the preceding week**
- **some non-coplanar maneuvers are greater than some maneuver angle and distributed properly across the week**
- **IRU configuration is A1 and A2 or B1 and B2**
- **the star catalog error is less than 0.6 arcsec**

Operational Implications: Scheduling IRU Calibrations (1 of 2)

Perform an IRU calibration prior to "long" maneuvers

- **scheduling 2 or more calibration maneuvers of up to 40 minutes each**
- **scheduling a ground contact as soon as possible after the end of the calibration maneuvers**
- **performing the ground IRU calibration and uplink parameter computations within the scheduled ground contact**
- **or, scheduling a second ground contact (nominally 8 hours later) to uplink the computed IRU calibration parameters**

Or, ensure at least 15 acceptably long, non-coplanar maneuvers properly distributed prior to a "long" maneuver

Operational Implications: Scheduling IRU Calibrations (2 of 2)

Science implications

- **1.5 hours (or more) of science time could be lost for calibration prior to each “long” maneuver**
- **more than one long observation (> 40,000 seconds) is unlikely to be scheduled in a week**
- **more time spent maneuvering to meet minimum maneuver criteria or add calibration maneuvers**

Potential contingencies are

- **loss of ground contacts delaying ground computations and resulting in failure to acquire stars**
- **must schedule calibration prior to target of opportunity**
- **must perform calibration prior to recovery from safemode**

Questions

What is the effect on the analysis of realistic IRU on-orbit performance?

What is the effect on the analysis of a realistic maximum maneuver angle of 145 degrees?

What is the minimum maneuver angle and appropriate maneuver distribution (over time and spacecraft axes) to achieve necessary maneuver accuracy?

What is the effect of fewer maneuvers (longer observation durations) on the analysis?

What is the appropriate balance between optimizing science time versus IRU calibration data?

What is the effect on the analysis of a star catalog error of 1 arcsec?